

## **Element 1g - SWP and CVP Fish Salvage (2012)**

This chapter contains an annual summary report of State Water Project (SWP) and Central Valley Project (CVP) salvage and presents the available data for temporary barrier operations and project exports. Seasonal fish barriers are thought to reduce fishery impacts by reducing entrainment of fish at the Skinner Delta Fish Protective Facility (SWP) and Tracy Fish Collection Facility (CVP). Of particular interest in this chapter is the Spring Head of Old River Barrier (SHORB) due to its intended purpose as a fish barrier. This barrier is designed to increase San Joaquin River Chinook salmon smolt survival by preventing them from entering Old River where they are more likely to be entrained into the SWP and CVP fish facilities.

A physical SHORB was installed in most years between 1992–2007, except during years with high San Joaquin River flows (1995, 1998, 1999, 2005, and 2006). In addition, the SHORB was not installed in 2008 in accordance with a court ruling to protect Delta smelt. In 2009 and 2010, a non-physical barrier or “bubble barrier” was installed instead of a physical barrier at Head of Old River as a pilot project to prevent salmon from entering Old River. During the 2011 season, installation of a non-physical barrier could not be installed due to high flows in the San Joaquin River. High velocity currents resulting from late season storm activity and associated heavy snow pack created conditions that were too dangerous to install a barrier. In 2012, Judge Lawrence J. O’Neill issued a Joint Stipulation which mandated that installation of the rock barrier take place at the Head of Old River. The Head of Old River, Middle River, and Old River Tracy Temporary Rock Barriers were installed approximately two weeks early in 2012. The early closure of the Head of Old River Rock barrier was intended to benefit out-migrating juvenile Chinook salmon and steelhead.

Ideally salvage data would indicate the effectiveness of the SHORB as it can show trends in fish entrainment during barrier operations and may provide insight on entrainment of San Joaquin River origin fish. However, the use of salvage data as an indicator of the effectiveness of the SHORB has always been difficult to ascertain due to the complexities involved with analyzing a multitude of variables. Such variables include export rates, local population dynamics of fishes in the South Delta and Clifton Court Forebay, Delta hydrodynamics, and barrier influences of the South Delta flow. Furthermore, it is difficult to accurately determine causal relationships between variables. In addition to these factors, the use of the non-physical barrier is likely to have a different effect than the traditional SHORB physical barrier. As a result of these complexities, this chapter focuses solely on presenting the available data regarding changes in temporary barrier operations, project exports, and listed species salvaged at both the SWP and CVP fish facilities during 2012.

## Data Collection

The data presented in this chapter came from multiple sources. Project water exports and salvage data for the SWP and CVP fish facilities were downloaded from DFG Bay-Delta Office ftp website (<ftp://ftp.delta.dfg.ca.gov>). Barrier operations were obtained from the “Weekly Updates” and “Operating Schedule” of the Temporary Barriers Project, which are posted on the DWR South Delta Branch website (<http://sdelta.water.ca.gov>).

While all the temporary barriers are noted in the table below, the SHORB is the only barrier traditionally focused on in this chapter, due to its intended purpose as a fish barrier (the remaining barriers serve as agricultural barriers). According to the 2008 Biological Opinion issued by NOAA, “The Head of Old River Barrier is designed to improve migration conditions for Central Valley fall-run Chinook salmon originating in the San Joaquin River watershed during adult and juvenile migrations (i.e., fall and spring) by ‘blocking’ migratory movements into the Old River channel from the mainstem San Joaquin River.”

Temporary barrier installations for 2012 were completed as follows:

**Table 2-1**

Barriers	Installation Started	Closure	Complete Removal
Spring Head of Old River Barrier	March 15, 2012	April 1, 2012	June 20, 2012
Non-Physical Barrier	Not Installed 2012	Not Installed 2012	Not Installed 2012
Middle River	March 12, 2012	March 16, 2012	Oct 29, 2012
Old River near Tracy	March 15, 2012	March 31, 2012	Nov 8, 2012
Grantline Canal	April 5, 2012	May 5, 2012*	Nov 6, 2012
Fall Head of Old River	Not Installed 2012	Not Installed 2012	Not Installed 2012

\* Grantline Canal partial closure occurred on April 19, 2012.

## Methods

In the study entitled “Losses of Sacramento River Chinook Salmon and Delta Smelt to Entrainment in Water Diversion in the Sacramento-San Joaquin Delta” by Kimmerer (2008), correlative analyses suggested that the proportion of fish salvaged increased with export flow. Due to this possible correlation between salvage counts and the amount of water exported, graphs of daily water export data and fish salvage data are plotted for listed species entrained at either the SWP or the CVP fish facility (Figures 2-1 through 2-10). Listed fish species include Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*Oncorhynchus mykiss irideus*), splittail (*Pogonichthys macrolepidotus*), longfin smelt (*Spirinchus thaleichthys*), and Delta smelt (*Hypomesus transpacificus*) (see Table 2-2 for

listing status). Chinook salmon has various Environmentally Significant Units (ESUs) listed under both the Federal and California Endangered Species Acts (FESA and CESA); however, salvage data do not differentiate between these ESUs and data are thus presented by species.

**Table 2-2: Special Status Species**

Common Name	Scientific Name	FESA Status*	CESA Status*	CDFG Status*
Chinook salmon, Central Valley fall/late fall-run ESU	<i>Oncorhynchus tshawytscha</i>	None	None	SSC
Chinook salmon, Central Valley spring-run ESU	<i>Oncorhynchus tshawytscha</i>	T	T	None
Chinook salmon, Sacramento River winter-run ESU	<i>Oncorhynchus tshawytscha</i>	E	E	None
Steelhead, Central Valley ESU	<i>Oncorhynchus mykiss irideus</i>	T	None	None
Sacramento splittail	<i>Pogonichthys macrolepidotus</i>	None	None	SSC
Longfin smelt	<i>Spirinchus thaleichthys</i>	None	T	SSC
Delta smelt	<i>Hypomesus transpacificus</i>	T	E	None

\*T= Threatened, E= Endangered, SSC= Species of Special Concern

## Fish Salvage Concerns

Fish salvage data should be examined to evaluate the effectiveness of barrier operations on entrainment. However, an examination of fish salvage as a sample of entrained fishes is complicated due to differences in how fish species and age groups respond to environmental conditions. The SWP and CVP fish facilities are not designed to effectively sample all fish equally. Salvage efficiency is related to the size of the fish, species, and age groups. In addition, due to the inherent variability in sizes of fish populations from year to year, significantly large proportions of stocks may be entrained because of their inability to escape the pump's zone of influence. For example, larval fishes are especially susceptible to entrainment due to their size and poor swimming performance.

Differences in SWP and CVP fish collection configurations complicate a comparison of the daily project salvage data relative to the position of species in the South Delta. Fish encounter Clifton Court Forebay prior to entry into the SWP fish facility which may directly or indirectly alter salvage estimates at this facility. In addition, the decline of Delta fish populations in general could be confounding factors in this qualitative analysis.

The salvage data for Chinook salmon is more likely to reveal trends related to the use of temporary barriers over time than salvage data for other species because the non-physical barrier is designed to decrease the amount of Chinook salmon entrained at the fish facilities. Since a barrier was installed at the Head of Old River in 2012, the data collected can be compared to past years' SHORB and non-physical barrier data to evaluate fish entrainment in the presence of a fish barrier.

## Salvage Data

As mentioned in the Fish Salvage Concerns section, there are complications in drawing specific conclusions from available data regarding the effect of the temporary barriers on fish populations. Water export fluctuation (both natural and human-induced) and the inherent variability in fish population dynamics from year to year, regardless of temporary barriers, makes it difficult to accurately assess the data and make correlations. However, export and salvage data are presented to document conditions in 2012.

Total salvage at the SWP fish facility for all fish species was 1,400,090 in 2012. Chinook salmon comprised 0.19% of the total, steelhead comprised 0.03% of the total, and Splittail comprised 0.03% of the total, longfin smelt comprised 0.20% of the total, and Delta smelt comprised 0.15% of the total. All together the five listed species taken into consideration in this chapter comprised 0.60% of the total fish salvage at the SWP fish facility.

Total salvage at the CVP fish facility for all fish species was 690,362 in 2012. Chinook salmon comprised 0.33% of the total, steelhead comprised 0.07% of the total, Splittail comprised 0.11% of the total, longfin smelt comprised 0.13% of the total, and Delta smelt comprised 0.06% of the total. All together the five listed species taken into consideration in this chapter comprised 0.70% of the total fish salvage at the CVP fish facility.

In comparison, total salvage at SWP and CVP for 2011 was much higher with 3,337,939 and 8,521,746 respectively. It should also be noted that salvage for the five listed species was considerably lower in 2012 than in 2011. In 2010, these five comprised 40.41% of the total SWP salvage and 90.10% of the total CVP salvage. Whereas in 2012, they comprised 0.60% of the total SWP salvage and 0.70% of the total CVP salvage.

Daily water export and fish salvage data are presented in graphical form (Figures 2-1 through 2-10) using relative exports and listed fish species for both the SWP and the CVP. These figures are summarized below:

**Table 2-3**

Figure	Location	Species
2-1	SWP	Chinook salmon
2-2	CVP	Chinook salmon
2-3	SWP	Steelhead
2-4	CVP	Steelhead
2-5	SWP	Splittail
2-6	CVP	Splittail
2-7	SWP	Longfin smelt
2-8	CVP	Longfin smelt
2-9	SWP	Delta smelt

2-10	CVP	Delta smelt
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## Recommendations

It appears that significant correlations between fish species densities and changes in water project hydrodynamics are complicated by variability of fish sampling and yearly water fluctuations. Due to this uncontrolled variability, the data collected for this monitoring report do not provide the ability to draw accurate conclusions on fish entrainment and salvage in the presence of a Head of Old River barrier.

Additional data such as genetic and coded-wire tag information of salvaged Chinook can be useful to determine stock origin of entrained fish. Evidence of entrainment of San Joaquin River origin fish would provide valuable insight to the degree of effectiveness of the SHORB on Chinook migration through the Delta. The use of these data for analysis would be aided by the inclusion of ecological data on fish populations in the Delta. Understanding the variability in fish population size and population dynamics in the Delta is essential to place fish salvage trends into context. Additional data may be available from research activities including DWR's Interagency Ecological Program (IEP) studies and the Operations Criteria and Plan (OCAP) studies for the CVP and the SWP. However, population estimates can be highly variable due to similar complexities that hinder our analyses of salvage data. The recent implementation of the non-physical barrier also adds or changes many variables in the analysis. Research regarding the effectiveness of the non-physical barrier might aid in the analysis of barrier effects on fish salvage.

Figure 2-1

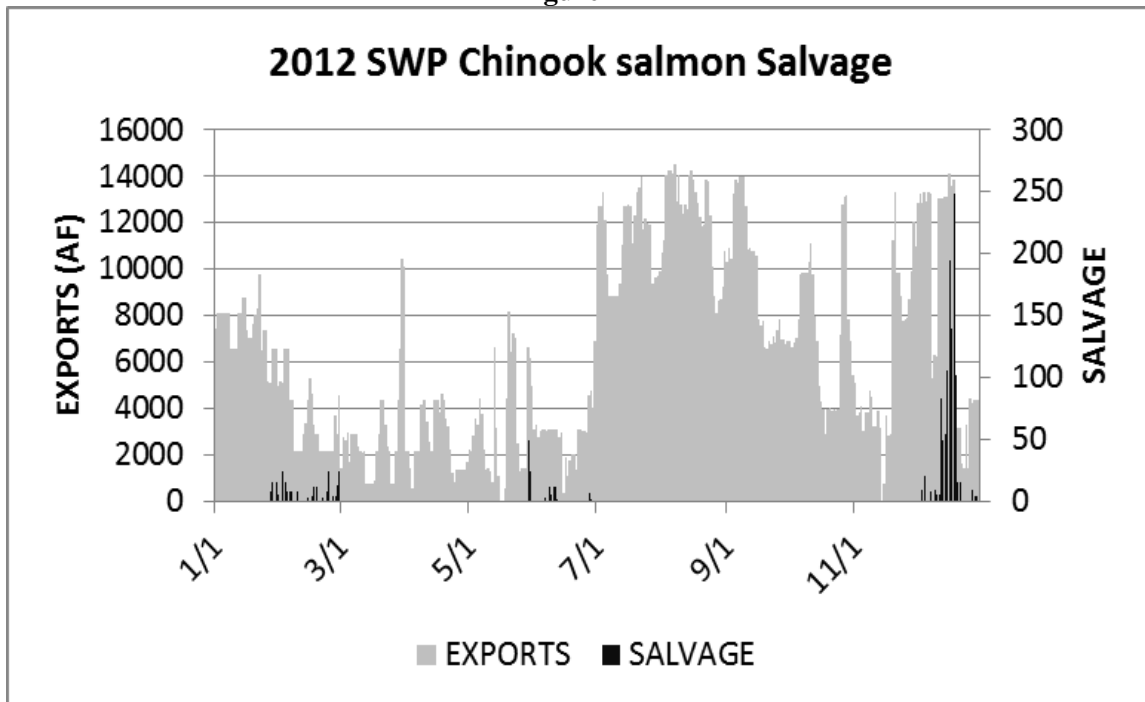


Figure 2-2

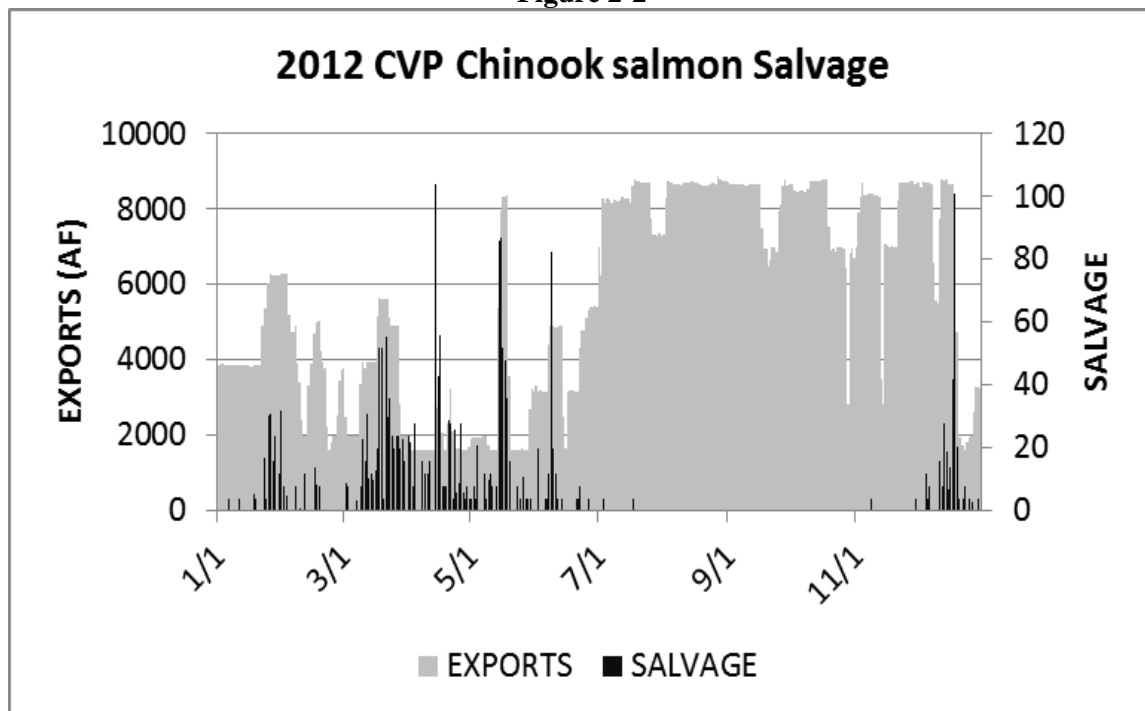


Figure 2-3

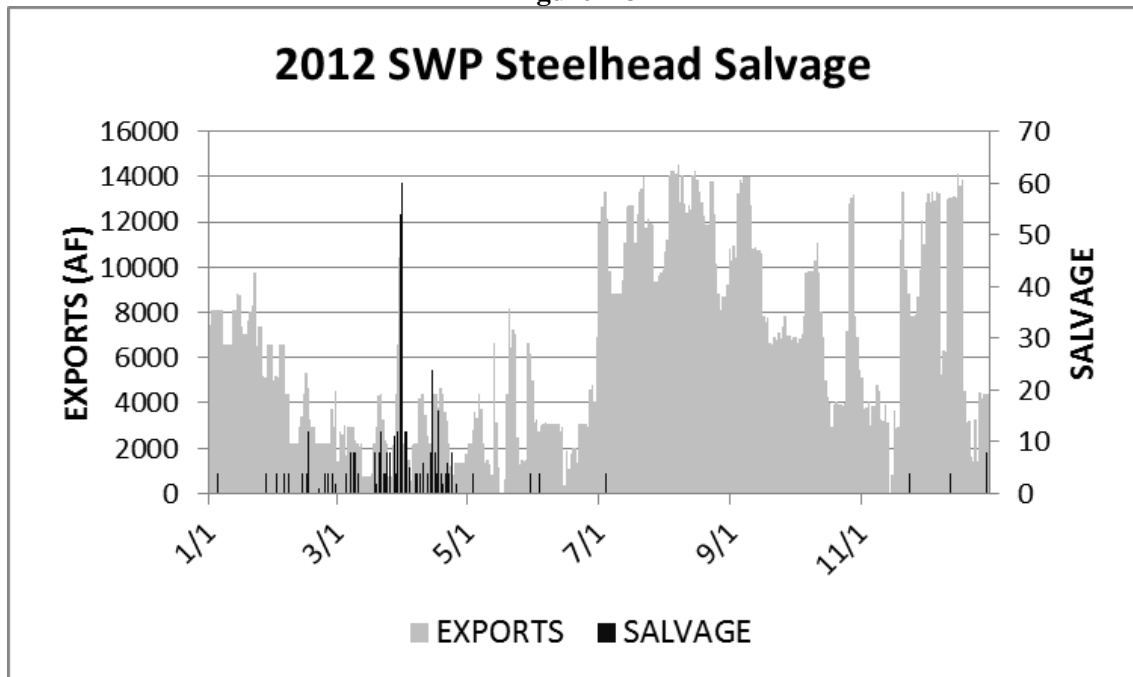


Figure 2-4

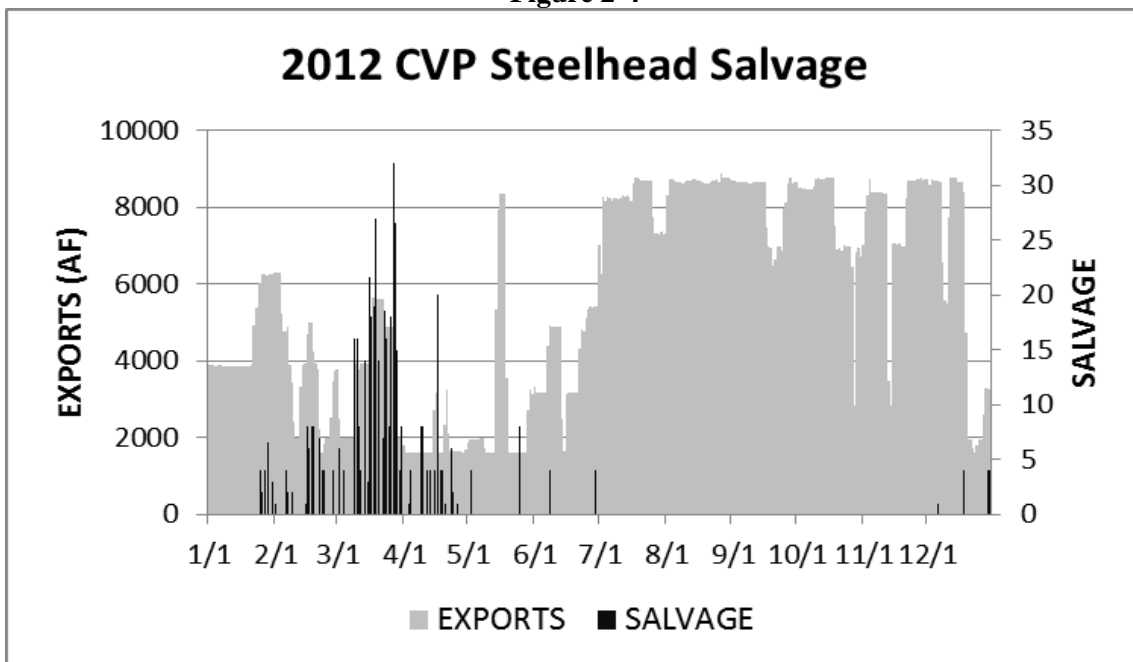


Figure 2-5

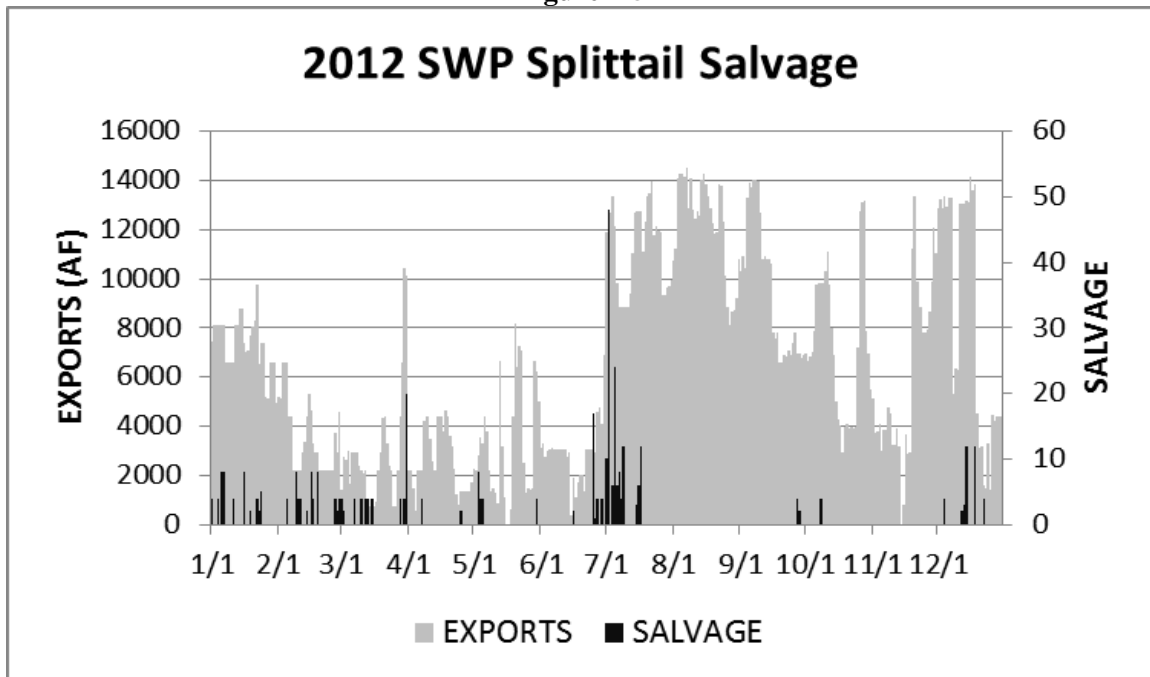


Figure 2-6

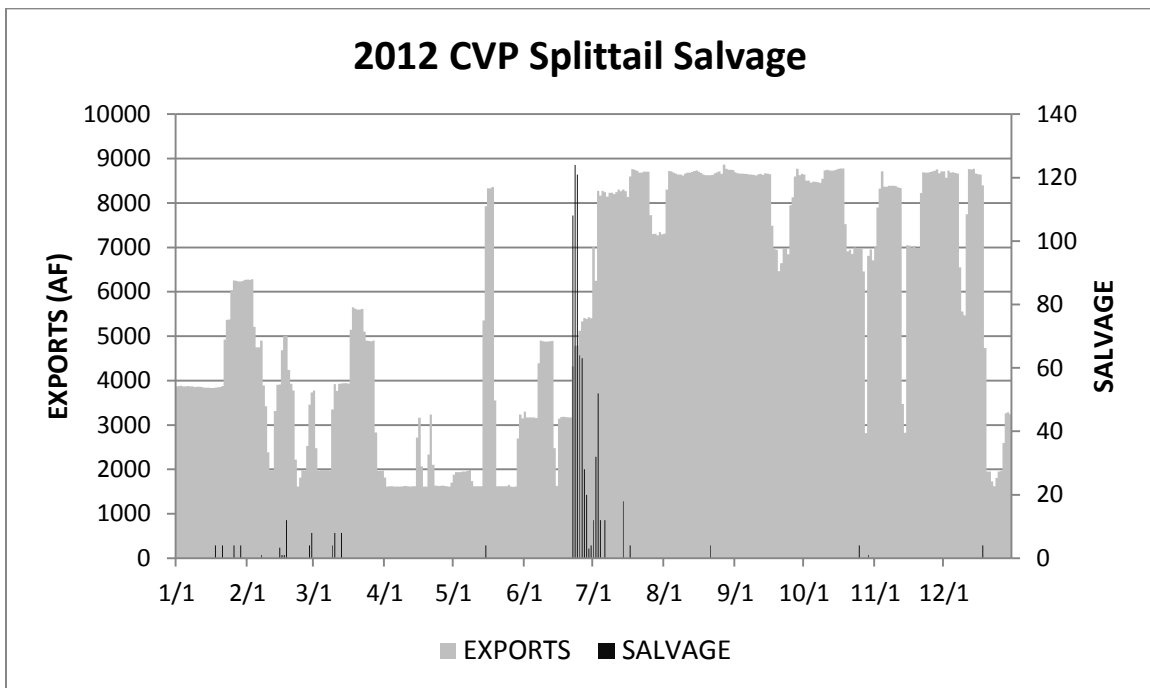




Figure 2-7

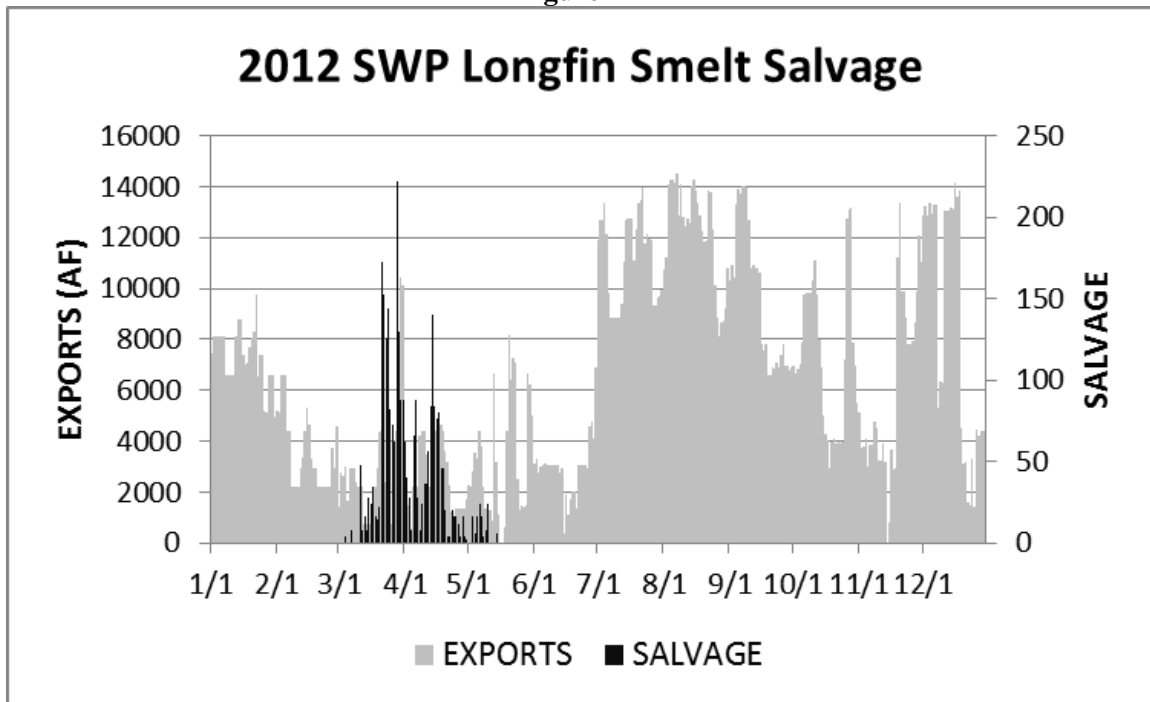


Figure 2-8

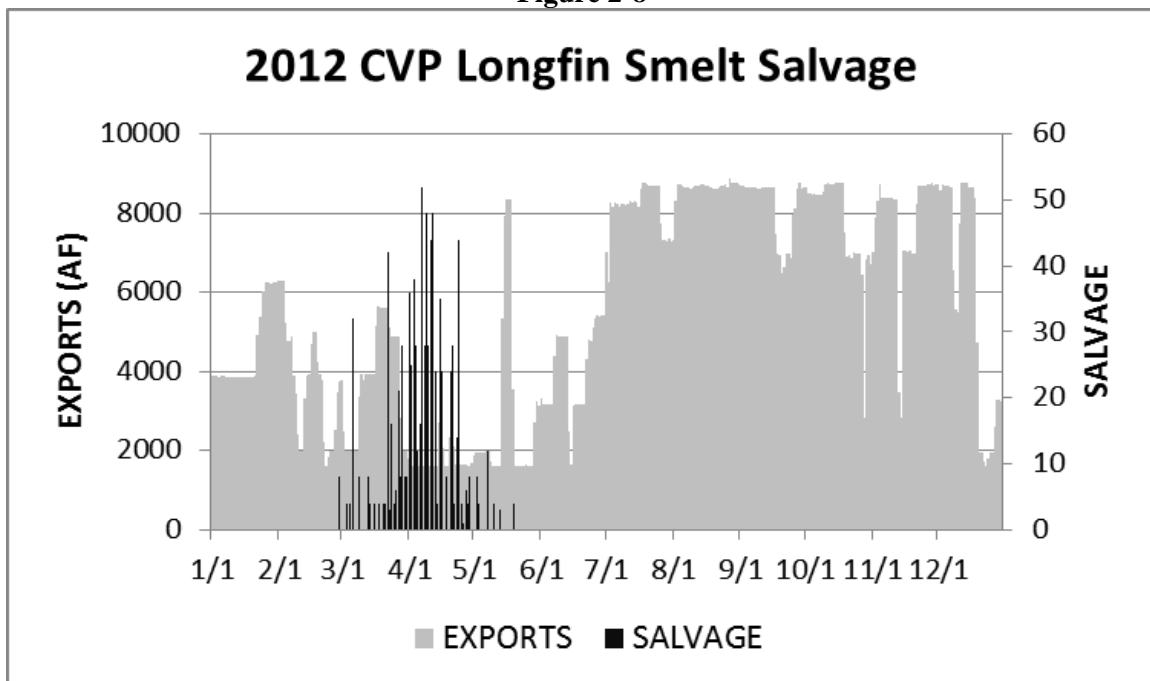


Figure 2-9

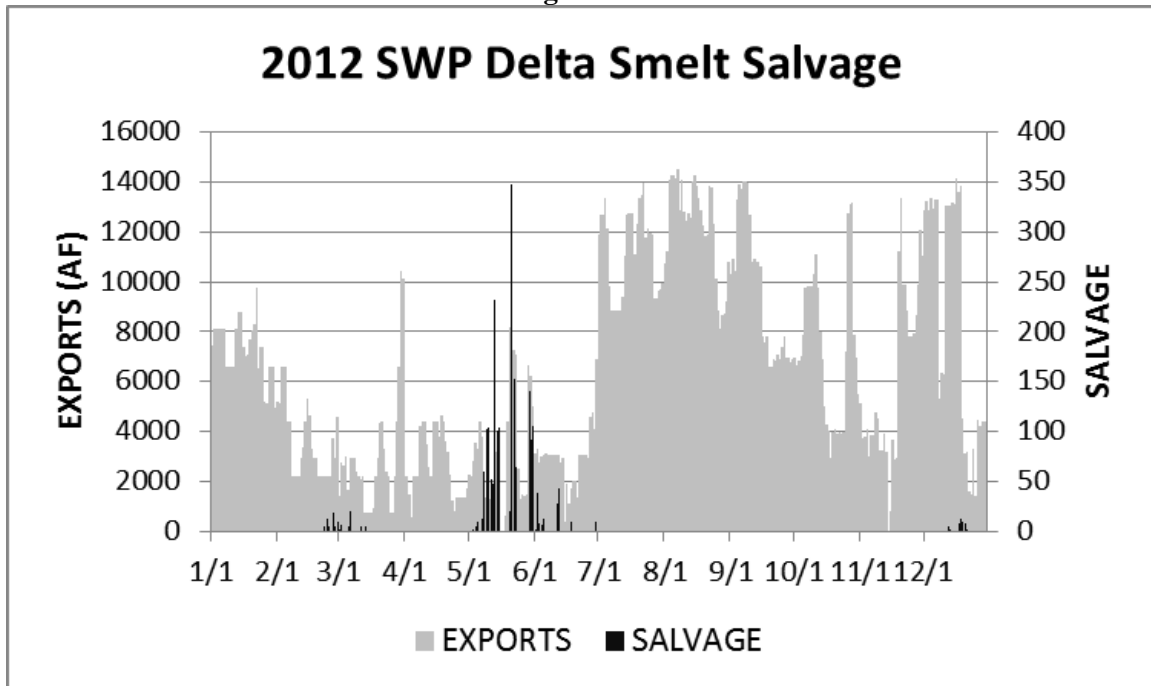
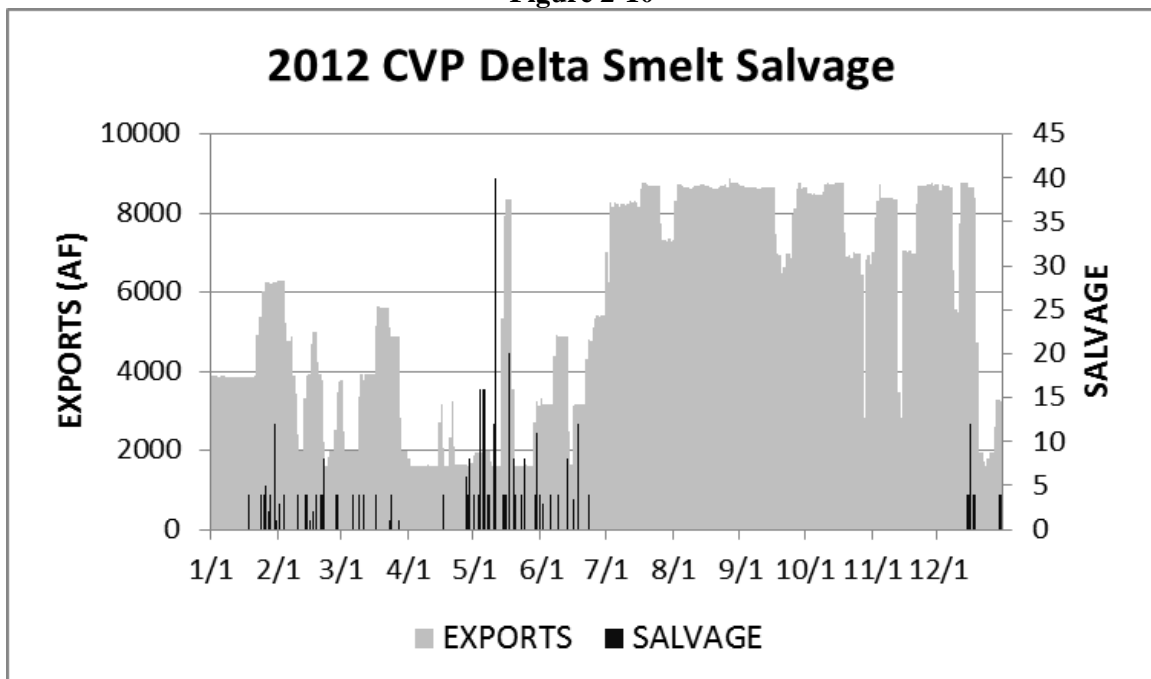


Figure 2-10



## References

DWR, 2011. 2009 South Delta Temporary Barriers Monitoring Report.

DWR, 2012. 2010 South Delta Temporary Barriers Monitoring Report.

Kimmerer, Wim J., 2008. "Losses of Sacramento River Chinook Salmon and Delta Smelt to Entrainment in Water Diversions in the Sacramento- San Joaquin Delta." San Francisco Estuary and Watershed Science. Vol. 6, Issue 2 (June), Article 2.

National Oceanic and Atmospheric Administration, 2008. Biological Opinion for the "Reinitiation of formal consultation for the South Delta Temporary Barriers Project and extension of the Project until 2010."

San Joaquin River Group Authority, 2008. "2007 Annual Technical Report: On implementation and monitoring of the San Joaquin River agreement and the Vernalis Adaptive Management Plan."